

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
RESTRAINT, 4000, ITEM 106 (1) LEFT (1) RIGHT ----- 0106-88936-11/12 (2)	3/2RB	Loss of attachment, restraint/bladder. Defective material; Adhesive, thread.	END ITEM: Bladder misaligned with restraint. GFE INTERFACE: Localized bladder loading and shifting. Crewman discomfort due to pressure points.	A. Design - 4000/Phase VI: The bladder is secured to the restraint fabric using anchor strips, urethane coated polyester (4000) or urethane coated nylon (Phase VI), sewn to the restraint fabric using "B" or "E" polyester thread. A double sided pressure sensitive adhesive tape is applied to these anchor strips to attach them to the bladder. This adhesive retains its tack while providing a semi permanent bond.
RESTRAINT, PHASE VI, ITEM 106 (1) LEFT (1) RIGHT ----- 0106-812146-01/02 (2)				4000: Front and back of each finger, above and below the proximal joint, except little finger and thumb. Front and back of little finger, near first joint. Front and back of thumb, near joint. Across back of hand, above knuckles. Six places throughout length of wrist.
----- 0106-812146-03/04 (2)			MISSION: None with loss of first or second attachment. Terminate EVA with excessive discomfort. CREW/VEHICLE: None. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: Days. TIME REQUIRED: Hours. REDUNDANCY SCREENS: A-PASS B-FAIL C-PASS	4000: At each fingertip and thumb tip the tape is placed in an "X" pattern around the circumference of the bottom of each finger cap. The bladder is indexed to a mounting flange which interfaces with the wrist bearing. Phase VI: Alignment is maintained by matching location marks on the bladder to corresponding marks on the restraint. There are 32 anchor strips used to attach and locate the restraint to the bladder. There are anchor strips in each finger tip corresponding to the finger nail position and an anchor strip on the form and back side of each finger. On the back side of the hand there is an anchor strip at the base of the thumb just above the gimbal swivel. In the wrist portion of the glove there are 4 anchor strips circumferentially located under each gimbal ring and each tight line. On the 4000 Series Gloves, anchor strips are attached to the restraint using a lock stitch type 301 per FED-STD-751A, 8 to 10 stitches per inch utilizing size "B" and size "E" polyester thread. On the Phase VI Glove, anchor strips are attached to the restraint using 8 to 10 stitches per inch utilizing size "B" polyester thread. Stitching is terminated by back tacking and by knotting on the restraint side to prevent separation of anchor strip seams from the restraint. Knotted seam terminations are further secured by application of adhesive to those knots. All anchor strip stitches are covered with the attachment adhesive tape locking individual stitches. Separation of three bladder attachment points are required to prevent glove donning.
				B. Test - 4000/Phase VI: PDA Test - Fit check and cycling are performed by test subject to verify proper fit per ILC Document 0111-70028 for the 4000 Series glove or 0111-710112 for the Phase VI gloves.

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106FM01

Certification Test -

4000:

The glove restraint assembly was successfully manned tested during SSA certification testing to duplicate operational life. (Ref: Cert Test Report for the Glove, ILC Document 0111-79241).

The following usage, reflecting requirements of significance to the glove restraint assemblies, was documented during certification.

Requirements	S/AD	Actual
Glove Joint Cycles		
Flex/Ext (Fingers)	42,412	56,726
Wrist Joint Cycles		
Add/Abd	21,206	29,484
Flex/Ext	21,206	29,484
Rotations	21,206	29,484
Pressurized Hours	461	615
Pressurized Cycles	432	576
Donn/Doff Cycles	144	192

The glove restraint assemblies were successfully subjected to an ultimate pressure of 13.2 psig during SSA certification testing (Ref. ILC Document 0111-79241). This is 1.5 times the BTA maximum operating pressure of 8.8 psig.

Phase VI:

The glove restraint assembly was successfully tested (manned) during certification testing to duplicate operational usage (Ref. Certification Test Report for the Phase VI Glove, ILC Doc. 0111-712701). The following usage, reflecting requirements of significance to the glove restraint assembly, was documented during certification testing. The S/AD applies 229 hours in certification while the actual indicates 198 hours toward the Phase VI glove restraint in the Hamilton Sundstrand Limited Life Items list (EMU1-19-001).

Requirements	S/AD	Actual
Glove Joint Cycles		
Flex/Ext (fingers)	45142	39169
Wrist Joint Cycles		
Add/Abd	17104	14830
Flex/Ext	12646	10830
Rotations	20112	17393
Pressurized Hours	229	198
Pressurized Cycle @ 4.3 psig	97	99
5.3 psig	37	63
6.6 psig	16	18
Don/Doff Cycles	49	49

C. Inspection -

4000/Phase VI:

Components and material manufactured to ILC requirements at an approved supplier are documented from procurement through shipping by the supplier. ILC incoming receiving inspection verifies that the materials received are as identified in

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		106FM01		<p>the procurement documents, that no damage has occurred during shipment and that the supplier certifications have been received which provide traceability information.</p> <p>MIP's are performed for visual inspection for presence of and location of anchor strips, and for absence of damage after inflation to 6.6 psig. Engineering evaluation of the inflated glove assembly is performed at the completion of manufacturing, and visual inspection is performed at PDA per ILC Document 0111-70028 for the 4000 Series glove or 0111-710112 for the Phase VI gloves.</p> <p>D. Failure History - J-EMU-106-A001 (9/19/89). Double sided anchor tape came loose from both the right and left glove bladder assemblies. ECO 901-0116 adds a repair procedure to replace the anchor tape if this problem occurs in the field. J-EMU-106-A002 (9/25/89). Tracked by J-EMU-106-A001.</p> <p>Phase VI: None.</p> <p>E. Ground Turnaround - During ground turnaround, in accordance with FEMU-R-001, the glove is visually inspected (pressurized and unpressurized) with TMG removed for material damage or degradation. Additionally, a crewperson fit check (pressurized) is required prior to flight to verify crewperson fit. Also, glove and EMU level structural and leakage tests are performed. Every 56 hours of manned pressurized time on the 4000. The glove restraint and bladder assembly is removed from the disconnect and subjected to a visual inspection (interior and exterior surfaces) to the extent possible for structural integrity, material degradation or damage.</p> <p>F. Operational Use - Crew Response - Pre/post-EVA : If bladder fold or pressure point is objectionable, crewmember can use backup gloves. EVA: Continue EVA. If excessive crewmember discomfort due to pressure points, terminate EVA. Special Training - No training specifically covers this failure mode. Operational Considerations - Not applicable.</p>

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-106 GLOVE ASSEMBLY
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

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